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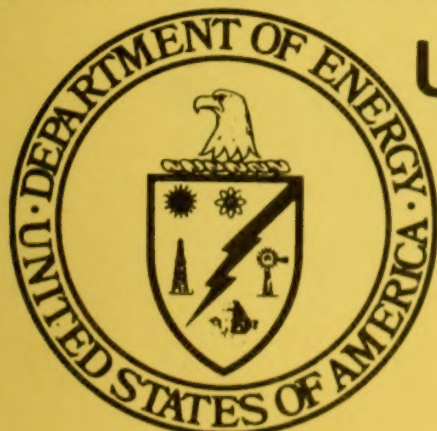
SOLAR/1015-79/05



Monthly Performance Report

PERL-MACK ENTERPRISES, INC.

MAY 1979



U.S. Department of Energy

National Solar Heating and
Cooling Demonstration Program

National Solar Data Program

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MONTHLY PERFORMANCE REPORT
PERL-MACK ENTERPRISES, INC.
MAY 1979

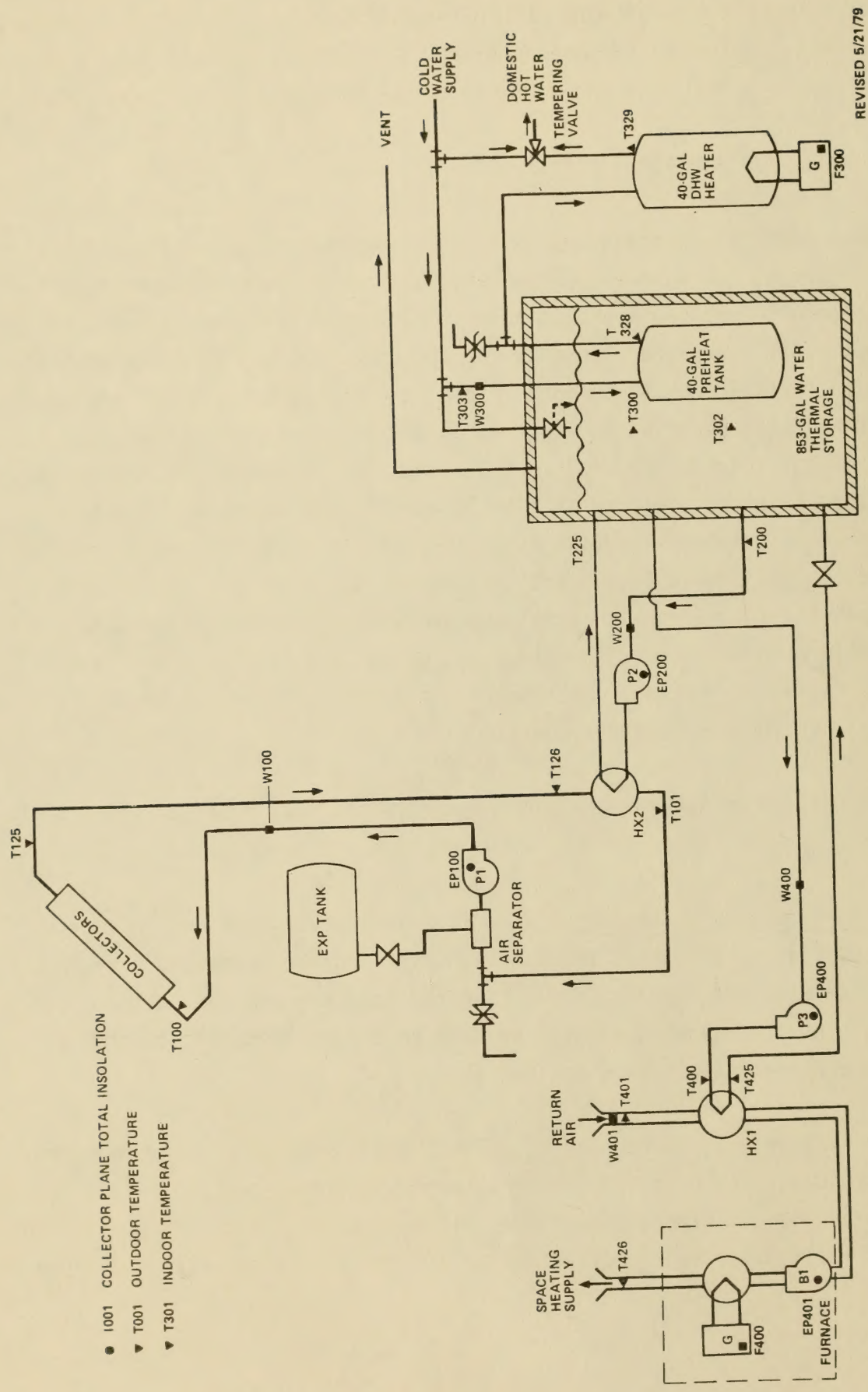
I. SYSTEM DESCRIPTION

The Perl-Mack Enterprises, Inc. site is a single family dwelling, 2,229 square feet of living area, in Denver, Colorado. The solar energy system is designed to provide approximately 68 percent of the annual space heating and hot water energy requirements for the home. It has an array of flat-plate collectors, manufactured by Miromit, with a gross area of 470 square feet that faces south at an angle of 30 degrees from the horizontal. A water-glycol solution is used as the medium for delivering solar energy from the collector array to storage located in the basement. The energy is stored in a 853-gallon tank after the transfer fluid passes through a liquid-to-liquid heat exchanger. Preheating of incoming city water is accomplished in a 40-gallon tank immersed within the 853-gallon tank. A gas burner in a conventional, 40-gallon hot water tank furnishes auxiliary energy for water heating. When solar energy is insufficient, a forced air, natural gas furnace provides additional energy for space heating.

The system, shown schematically in Figure 1, has five modes of solar operation.

Mode 1 - Collector-to-Storage: This mode is entered when the collector outlet temperature exceeds the water thermal storage temperature by 10°F (adjustable). The transfer fluid is circulated through the collectors, through the heat exchanger HX2, and back to the collectors until the temperature differential drops to less than 2°F.

Mode 2 - Storage-to-Space Heating: This mode prevails when the room temperature drops to the setting of the thermostat, and the temperature in the water thermal storage is 90°F or higher. Energy from storage is transferred to liquid-to-air heat exchanger HX1 located in the air-handling unit.



REVISED 5/21/79

Figure 1. PERL-MACK ENTERPRISES SOLAR ENERGY SYSTEM SCHEMATIC

Mode 3 - Domestic Water Preheat: This mode exists when there is a demand for hot water. Incoming city water flows through the preheat tank immersed in the water thermal storage and then to the conventional hot water heater (DHW heater).

Mode 4 - Excess Heat Rejection: This mode occurs when the water thermal storage temperature exceeds 170°F and Mode 1 has been terminated. Pumps P1 and P2, in this mode, extract energy from storage and transfer it to the collectors for exchange to the outside ambient air. In addition, vapor in the water thermal storage is vented to the outside of the house.

Mode 5 - Snow Removal from Collector: This mode is accomplished by a manual override switch which permits the homeowner to turn on the collector pump P1 and storage pump P2 to transfer energy from water thermal storage to the collectors. The purpose of this mode is to remove snow from the collectors before normal insolation and collection would be expected to begin. This mode terminates automatically after a preset time interval of approximately 15 minutes.

II. PERFORMANCE EVALUATION

The system performance evaluations discussed in this section are based primarily on the analysis of the data presented in the attached computer-generated monthly report. This attached report consists of daily site thermal and energy values for each subsystem, plus environmental data. The performance factors discussed in this report are based upon the definitions contained in NBSIR 76-1137, Thermal Data Requirements and Performance Evaluation Procedures for the National Solar Heating and Cooling Demonstration Program.

A. Introduction

The solar energy system at the Perl-Mack Enterprises, Inc. site operated continuously during the month of May except for five days where no collection took place because of very low insolation.

For each month of this heating season, the instrumentation, which measures the natural gas usage, has become progressively less reliable when a comparison is made between the measured gas usage and the gas billing for the month as received by the homeowner. For the month of May, the billing receipts have been used as a baseline, and the measured natural gas usage for heating and domestic hot water have been modified accordingly.

With these adjustments to the data, the solar contribution was 62 percent of the combined heating and domestic hot water load of 2.91 million Btu, and was produced at the expense of 0.27 million Btu to operate electrical pumps in the solar energy collection and storage subsystem (ECSS).

B. Weather

The average outside ambient temperature for May was 54°F as compared with the long-term average of 57°F. The measured insolation in the collector plane averaged 1,596 Btu/ft²-day. The long-term average insolation for May is 2,025 Btu/ft²-day derived from measurements taken at the Denver airport.

C. System Thermal Performance

Collector - Of the 23.25 million Btu of energy incident on the collector array, 15.53 million Btu were incident on the array when pumps P1 and P2 (Figure 1) were operating. The system collected 6.99 million Btu, or 30 percent of the total insolation incident on the collector array. The operation of pumps P1 and P2 consumed 0.27 million Btu of electrical energy during collection.

Storage - Of the 6.99 million Btu of solar energy collected, 5.93 million Btu were delivered to the water thermal storage. Delivery loss between the collector and storage was 1.06 million Btu. A total of 2.10 million Btu was removed from storage for use by the loads, and the net change in energy within the water thermal storage for the month was a net loss of

0.11 million Btu. Storage losses of 3.94 million Btu resulted in a storage efficiency of 34 percent. Relatively poor solar insolation for the month resulted in an average storage temperature of 127°F, ranging from a low of 88°F to a high of 146°F.

Domestic Hot Water Load - An average of 89 gallons of hot water was used each day of occupancy, and was delivered at an average temperature of 143°F. The consumed hot water was replaced with cold water at an average temperature of 59°F, which resulted in a measured total hot water load of 1.96 million Btu. The total hot water load is independently measured, as well as the solar energy used, and the auxiliary thermal energy used. The difference between the sum of the solar and auxiliary contributions and the total load is assigned to plumbing energy losses and averaged 0.41 million Btu for the month. The solar fraction was 64 percent.

Space Heating Load - The space heating solar energy usage of 0.57 million Btu represented 60 percent of the total space heating load of 0.95 million Btu. The auxiliary fossil fuel of 0.60 million Btu provided 0.38 million Btu of auxiliary thermal energy based on an assumed furnace efficiency of 64 percent.

D. Observations

The solar system operation was normal. Auxiliary energy was used for space heating through May 11 and then discontinued for the remainder of the month. There was no collection for five days because of low insolation. This affected storage temperatures and solar fractions in turn. Losses of 5.40 million Btu to the conditioned space continue to be typical of past performance.

E. Energy Savings

The Perl-Mack solar energy system resulted in estimated savings of 3.44 million Btu of natural gas during May, at the expense of -0.29 million Btu of electricity for operating the solar energy portion of the system. The

savings are based solely on the use of controlled solar energy, as measured, and do not include losses. The savings of 3.44 million Btu are the natural gas equivalent of the 2.10 million Btu of solar energy assumed to have been removed from storage and supplied to the conditioned space and to the domestic hot water heater. The electrical savings of -0.29 million Btu are the equivalent of 0.96 million Btu of fossil energy required at the power plant to generate the electrical energy used.

III. ACTION STATUS

None.

SOLAR HEATING AND COCLING DEMONSTRATION PROGRAM

MONTHLY REPORT SITE SUMMARY

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979

SOL AR/1015-79/05

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER AND SPACE HEATING FOR A SINGLE FAMILY RESIDENCE. FLAT PLATE COLLECTORS USE GLYCOL-WATER FLUID. A HEAT EXCHANGER TRANSFERS ENERGY TO A WATER STORAGE TANK WHICH PREHEATS WATER TO THE GAS FIRED DOMESTIC HOT WATER HEATER. SPACE HEATING IS PROVIDED BY AN AIR TO WATER HEAT EXCHANGER IN THE GAS FIRED FURNACE PLENUM.

GENERAL SITE DATA:

INCIDENT SOLAR ENERGY

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE
AVERAGE BUILDING TEMPERATURE
ECSS SOLAR CONVERSION EFFICIENCY
ECSS OPERATING ENERGY
TOTAL SYSTEM OPERATING ENERGY
TOTAL ENERGY CONSUMED

23.248 MILLION BTU
49489 BTU/SQ.FT.
6.991 MILLION BTU
14882 BTU/SQ.FT.
54 DEGREES F
78 DEGREES F
0.09 MILLION BTU
0.272 MILLION BTU
0.413 MILLION BTU
9.394 MILLION BTU

SUBSYSTEM SUMMARY:

LOAD SOLAR FRACTION USED
SOLAR ENERGY USED
OPERATING ENERGY
AUX. THERMAL ENERGY
AUX. ELECTRIC FUEL
AUX. FOSSIL FUEL
ELECTRICAL SAVINGS
FOSSIL SAVINGS

HOT WATER
1.958
64
1.532
N.A.
0.834
N.A.
1.389
N.A.
2.553

HEATING
0.954
60
0.570
0.141
0.384
N.A.
0.6CC
-0.014
0.890

COOLING
N.A.
N.A.
N.A.
N.A.
N.A.
N.A.
N.A.
N.A.
N.A.

SYSTEM PERFORMANCE FACTOR:

0.865

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MCNTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,
SOLAR/0004-78/18

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT SITE SUMMARY

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979

SOLAR/1015-79/05

SITE/SYSTEM DESCRIPTION: THE SOLAR ENERGY SYSTEM PROVIDES DOMESTIC HOT WATER AND SPACE HEATING FOR A SINGLE FAMILY RESIDENCE. FLAT PLATE COLLECTORS USE GLYCOL-WATER FLUID. A HEAT EXCHANGER TRANSFERS ENERGY TO A WATER STORAGE TANK WHICH PREHEATS WATER TO THE GAS FIRED DOMESTIC HOT WATER HEATER. SPACE HEATING IS PROVIDED BY AN AIR TO WATER HEAT EXCHANGER IN THE GAS FIRED FURNACE PLENUM.

GENERAL SITE DATA: INCIDENT SOLAR ENERGY

COLLECTED SOLAR ENERGY

AVERAGE AMBIENT TEMPERATURE
AVERAGE BUILDING TEMPERATURE
ECSS SOLAR CONVERSION EFFICIENCY
ECSS OPERATING ENERGY
TOTAL SYSTEM OPERATING ENERGY
TOTAL ENERGY CONSUMED

24.527 GIGA JOULES
562001 KJ/SQ.M.
7.375 GIGA JOULES
168996 KJ/SQ.M.
12 DEGREES C
25 DEGREES C
0.05 GIGA JOULES
0.287 GIGA JOULES
0.436 GIGA JOULES
9.911 GIGA JOULES

SUBSYSTEM SUMMARY:

LOAD	HOT WATER	HEATING	COOLING
SOLAR FRACTION USED	2.066	1.006	N.A.
SOLAR ENERGY USED	64	60	N.A.
OPERATING ENERGY	1.616	0.601	N.A.
AUX. THERMAL ENG	N.A.	0.149	N.A.
AUX. ELECTRIC FUEL	N.A.	0.405	N.A.
AUX. ELECTRIC FUEL	N.A.	N.A.	N.A.
ELECTRICAL SAVINGS	1.466	0.634	N.A.
FOSSIL SAVINGS	2.694	-0.015	N.A.
		0.939	N.A.

SYSTEM PERFORMANCE FACTOR:

0.865

* DENOTES UNAVAILABLE DATA
@ DENOTES NULL DATA
N.A. DENOTES NOT APPLICABLE DATA

REFERENCE: USER'S GUIDE TO THE MONTHLY PERFORMANCE REPORT
OF THE NATIONAL SOLAR DATA PROGRAM, FEBRUARY 28, 1978,
SOLAR/0004-78/18

SYSTEM TOTAL
3.072 GIGA JOULES
62 PERCENT
2.217 GIGA JOULES
0.436 GIGA JOULES
1.285 GIGA JOULES
N.A. GIGA JOULES
2.095 GIGA JOULES
-0.302 GIGA JOULES
3.633 GIGA JOULES

SCLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT ENERGY COLLECTION AND STORAGE SUBSYSTEM (ECSS)

SCLAR / 1015-79/05

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	AMBIENT TEMP DEG-F	ENERGY TO LOADS MILLION BTU	AUX THERMAL TO ECSS MILLION BTU	ECSS OPERATING ENERGY MILLION BTU	ECSS ENERGY REJECTED MILLION BTU	ECSS SOLAR CONVERSION EFFICIENCY
1	0.786	53	0.061	NOT APPLICABLE	0.009	0.000	0.078
2	0.153	39	0.118		0.000	0.000	0.769
3	0.372	37	0.049		0.001	0.000	0.131
4	1.129	51	0.045		0.017	0.000	0.040
5	1.124	63	0.076		0.008	0.000	0.116
6	1.163	65	0.094		0.016	0.000	0.081
7	0.667	47	0.084		0.005	0.000	0.125
8	0.164	39	0.151		0.000	0.000	0.924
9	0.064	31	0.024		0.000	0.000	0.377
10	0.707	36	0.062		0.007	0.000	0.087
11	1.057	47	0.040		0.015	0.000	0.038
12	1.079	50	0.078		0.013	0.000	0.072
13	1.096	60	0.120		0.013	0.000	0.110
14	0.988	60	0.065		0.013	0.000	0.066
15	0.055	65	0.040		0.010	0.000	0.038
16	0.926	65	0.056		0.010	0.000	0.060
17	0.873	63	0.018		0.013	0.000	0.021
18	0.853	65	0.041		0.010	0.000	0.049
19	0.969	62	0.092		0.012	0.000	0.004
20	0.109	59	0.056		0.000	0.000	0.485
21	0.983	59	0.057		0.013	0.000	0.057
22	0.427	60	0.069		0.012	0.000	0.070
23	1.002	55	0.036		0.001	0.000	0.085
24	0.694	60	0.062		0.014	0.000	0.062
25	1.029	64	0.073		0.010	0.000	0.105
26	1.029	66	0.075		0.013	0.000	0.073
27	0.939	67	0.044		0.011	0.000	0.047
28	0.809	59	0.105		0.009	0.000	0.129
29	0.599	47	0.047		0.005	0.000	0.078
30	0.192	42	0.038		0.000	0.000	0.198
31	0.636	47	0.088		0.010	0.000	0.139
SUM	23.248	-	2.102	N.A.	0.272	0.000	-
AVG	0.750	54	0.068	N.A.	0.009	0.000	0.090
NRS ID	Q001	N113			Q102		N111

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT COLLECTOR ARRAY PERFORMANCE

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979
SOLAR/1015-79/05

DAY OF MONTH	INCIDENT SOLAR ENERGY MILLION BTU	OPERATIONAL INCIDENT ENERGY MILLION BTU	COLLECTED SOLAR ENERGY MILLION BTU	DAYTIME AMBIENT TEMP DEG F	COLLECTOR ARRAY EFFICIENCY
1	0.786	0.515	0.220	62	0.279
2	0.153	0.000	0.000	35	0.000
3	0.372	0.057	0.028	41	0.074
4	1.129	0.992	0.463	60	0.410
5	0.654	0.346	0.170	71	0.260
6	1.163	0.940	0.435	78	0.374
7	0.667	0.259	0.099	55	0.149
8	0.164	0.000	0.000	43	0.000
9	0.064	0.000	0.000	33	0.000
10	0.707	0.395	0.165	40	0.234
11	1.057	0.922	0.428	57	0.405
12	1.079	0.766	0.336	59	0.311
13	1.096	0.813	0.373	69	0.341
14	1.988	0.759	0.318	79	0.322
15	1.055	0.771	0.327	79	0.309
16	0.926	0.589	0.254	78	0.275
17	0.873	0.647	0.269	76	0.308
18	0.853	0.503	0.231	77	0.271
19	0.969	0.754	0.319	71	0.329
20	0.199	0.000	0.000	45	0.000
21	0.985	0.787	0.367	67	0.373
22	0.983	0.728	0.318	72	0.323
23	0.427	0.015	0.030	58	0.069
24	1.002	0.828	0.371	69	0.371
25	0.604	0.479	0.216	68	0.312
26	1.029	0.796	0.345	68*	0.335
27	0.939	0.653	0.313	79	0.333
28	0.809	0.548	0.253	78	0.313
29	0.599	0.235	0.113	70	0.189
30	0.192	0.000	0.000	45	0.000
31	0.636	0.436	0.230	54	0.362
SUM	23.248	15.533	6.991	-	-
AVG	0.750	0.501	0.226	62	0.301
NBSID	Q001		Q10C		N100

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT STORAGE PERFORMANCE

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979
SOLAR/1015-79/05

DAY OF MONTH	ENERGY TO STORAGE MILLION BTU	ENERGY FROM STORAGE MILLION BTU	CHANGE IN STORAGE MILLION BTU	STORAGE AVERAGE TEMP DEG F	STORAGE EFFICIENCY
1	0.197	0.061	0.003	128	0.325
2	0.000	0.118	-0.177	112	1.000
3	0.030	0.119	-0.060	110	-0.371
4	0.412	0.045	0.241	112	0.693
5	0.121	0.076	0.054	121	0.181
6	0.381	0.094	0.122	130	0.568
7	0.083	0.084	-0.147	125	-0.762
8	0.000	0.151	-0.222	103	-1.000
9	0.000	0.024	-0.045	88	1.000
10	0.150	0.062	0.058	92	0.797
11	0.381	0.040	0.236	110	0.724
12	0.291	0.078	0.068	128	0.500
13	0.301	0.120	0.030	134	0.500
14	0.273	0.065	0.064	140	0.476
15	0.280	0.040	0.032	146	0.255
16	0.226	0.056	-0.020	145	0.166
17	0.196	0.018	-0.016	143	0.128
18	0.278	0.092	-0.000	145	0.329
19	0.000	0.096	-0.212	128	1.000
20	0.317	0.059	0.035	138	0.579
21	0.267	0.069	0.035	128	0.388
22	0.006	0.036	-0.145	130	-19.062
23	0.163	0.073	-0.124	134	0.568
24	0.295	0.075	-0.023	141	0.305
25	0.240	0.044	0.097	141	0.584
26	0.221	0.105	0.030	148	0.310
27	0.107	0.047	0.068	144	0.116
28	0.107	0.038	-0.068	134	-0.203
29	0.000	0.038	-0.131	121	1.000
30	0.171	0.088	0.007	112	0.553
31					
SUM	5.931	2.102	-0.107	-	-
AVG	0.191	0.068	-0.003	127	0.336
NBS ID	Q200	Q201	Q202		N108

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM
MONTHLY REPORT
HCT WATER SUBSYSTEM

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979

SOLAR/1015-79/05

DAY OF MON.	HOT WATER LOAD MILLION BTU	SOLAR FR. OF LOAD PER CENT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	SUP. WAT. TEMP DEG F	HOT WAT. TEMP DEG F	HOT WATER USED GAL
1	0.061	63	0.050	NOT APPLICABLE	0.029	NOT APPLICABLE	0.048	NOT APPLICABLE	0.084	57	141	86
2	0.025	49	0.013		0.016		0.027		0.022	59	143	34
3	0.050	35	0.020		0.051		0.084		0.034	58	147	64
4	0.034	46	0.023		0.011		0.018		0.039	57	147	49
5	0.053	54	0.036		0.030		0.051		0.059	59	144	72
6	0.114	66	0.094		0.042		0.071		0.157	58	144	148
7	0.104	58	0.068		0.058		0.097		0.113	62	144	136
8	0.042	29	0.015		0.044		0.073		0.025	66	144	55
9	0.056	33	0.022		0.032		0.053		0.027	59	149	72
10	0.060	31	0.023		0.051		0.086		0.037	59	148	75
11	0.031	50	0.043		0.015		0.025		0.039	56	148	41
12	0.049	62	0.086		0.021		0.035		0.072	57	142	71
13	0.102	68	0.065		0.036		0.060		0.143	55	144	139
14	0.071	72	0.040		0.025		0.041		0.109	58	143	54
15	0.035	79	0.056		0.007		0.008		0.063	59	138	74
16	0.051	87	0.018		0.005		0.000		0.030	58	137	44
17	0.015	91	0.041		0.000		0.019		0.069	60	140	64
18	0.043	79	0.092		0.011		0.049		0.153	56	145	141
19	0.103	72	0.096		0.029		0.139		0.076	56	143	115
20	0.146	51	0.045		0.083		0.027		0.114	58	145	80
21	0.054	68	0.069		0.025		0.048		0.060	63	143	117
22	0.070	75	0.036		0.016		0.027		0.103	59	145	136
23	0.052	65	0.062		0.029		0.055		0.121	66	140	107
24	0.078	60	0.073		0.033		0.018		0.074	55	142	154
25	0.083	88	0.075		0.011		0.020		0.174	57	139	177
26	0.072	90	0.044		0.012		0.051		0.041	59	144	57
27	0.041	81	0.105		0.006		0.019		0.057	65	144	84
28	0.113	76	0.047		0.031		0.042		2.553	-	-	2756
29	0.150	77	0.025		0.025		0.061		0.082	59	143	89
30	0.042	54	0.034		0.037		1.389		0.082	59	143	89
31	0.057	51	0.034		0.037		0.045		0.082	59	143	89
SUM	1.958	-	1.532	N.A.	0.834	N.A.	1.389	N.A.	2.553	-	-	2756
AVG	0.063	64	0.049	N.A.	0.027	N.A.	0.045	N.A.	0.082	59	143	89
NBS	Q302	N300	Q300	Q303	Q301	Q305	Q306	Q311	Q313	N305	N307	N308

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MCNTHLY REPORT SPACE HEATING SUBSYSTEM

SOLAR / 1015-79/05

SITE: PERL-MACK ENTERPRISES
REPORT PERIOD: MAY, 1979

DAY OF MON.	SPACE HEATING LOAD MILLION BTU	SOLAR FR. OF LOAD PCT	SOLAR ENERGY USED MILLION BTU	OPER ENERGY MILLION BTU	AUX THERMAL USED MILLION BTU	AUX ELECT FUEL MILLION BTU	AUX FOSSIL FUEL MILLION BTU	ELECT ENERGY SAVINGS MILLION BTU	FOSSIL ENERGY SAVINGS MILLION BTU	BLDG TEMP DEG. F	AMB TEMP DEG. F
1	0.011	100	0.011	0.001	0.000	NOT APPLICABLE					53
2	0.104	100	0.104	0.016	0.000						39
3	0.092	31	0.028	0.065	0.064						37
4	0.044	49	0.022	0.005	0.022	NOT APPLICABLE					51
5	0.044	92	0.040	0.003	0.004						63
6	0.000	0	0.000	0.000	0.000						55
7	0.016	100	0.016	0.001	0.000	NOT APPLICABLE					47
8	0.136	100	0.136	0.019	0.000						39
9	0.210	42	0.008	0.006	0.202						31
10	0.093	30	0.017	0.005	0.054	NOT APPLICABLE					36
11	0.056	100	0.035	0.003	0.039						47
12	0.035	100	0.034	0.002	0.000						50
13	0.034	0	0.000	0.000	0.000	NOT APPLICABLE					60
14	0.000	0	0.000	0.000	0.000						60
15	0.000	0	0.000	0.000	0.000						55
16	0.000	0	0.000	0.000	0.000	NOT APPLICABLE					65
17	0.000	0	0.000	0.000	0.000						52
18	0.000	0	0.000	0.000	0.000						62
19	0.000	100	0.011	0.000	0.000	NOT APPLICABLE					49
20	0.011	0	0.000	0.000	0.000						59
21	0.000	0	0.000	0.000	0.000						60
22	0.000	0	0.000	0.000	0.000	NOT APPLICABLE					55
23	0.000	0	0.000	0.000	0.000						60
24	0.000	0	0.000	0.000	0.000						60
25	0.000	0	0.000	0.000	0.000	NOT APPLICABLE					64
26	0.000	0	0.000	0.000	0.000						66
27	0.000	0	0.000	0.000	0.000						67
28	0.000	0	0.000	0.000	0.000	NOT APPLICABLE					59
29	0.000	0	0.000	0.000	0.000						42
30	0.013	100	0.013	0.001	0.000						47
31	0.054	100	0.054	0.006	0.000	NOT APPLICABLE					47
SUM	0.954	-	0.570	0.141	0.384	N.A.	0.600	-0.014	0.890	-	-
AVG	0.031	60	0.018	0.005	0.012	N.A.	0.019	-0.000	0.029	78	54
NBS	Q402	N400	Q400	Q403	Q401		Q410	Q415	Q417	N406	N113

* DENOTES UNAVAILABLE DATA.
@ DENOTES NULL DATA.
N.A. DENOTES NOT APPLICABLE DATA.

SOLAR HEATING AND COOLING DEMONSTRATION PROGRAM

MONTHLY REPORT ENVIRONMENTAL SUMMARY

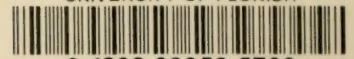
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REPORT PERIOD: MAY, 1979

SOLAR/1015-79/05

DAY OF MONTH	TOTAL INSOLATION BTU/SQ.FT	DIFFUSE INSOLATION BTU/SQ.FT	AMBIENT TEMPERATURE DEG F	CAYTIME AMBIENT TEMP DEG F	RELATIVE HUMIDITY PERCENT	WIND DIRECTION DEGREES	WIND SPEED M.P.H.
1	1673	NOT APPLICABLE	53	62	NOT APPLICABLE	NOT APPLICABLE	NOT APPLICABLE
2	325		33	35			
3	791		37	41			
4	2404		51	60			
5	1391		63	71			
6	2477		57	78			
7	1420		43	55			
8	1349		39	43			
9	1506		31	33			
10	2250		67	40			
11	2233		50	57			
12	2102		60	59			
13	2247		65	79			
14	1971		53	76			
15	1858		63	77			
16	1816		65	77			
17	2063		62	71			
18	4233		45	45			
19	2092		50	67			
20	2092		55	72			
21	908		60	58			
22	2132		60	68			
23	1477		64	68			
24	2190		66	79			
25	1999		67	78			
26	1723		59	70			
27	1276		47	45			
28	1409		47	54			
29	1354		47	54			
30	49489	N.A.	-	-	-	-	-
31	1596	N.A.	54	62	N.A.	N.A.	N.A.
SUM	49489	N.A.	N113			N115	N114
AVG	1596	N.A.					
NBS ID	Q001						

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